

**Amendments to the Claims:**

The listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently amended) An apparatus for detecting the presence of flame in the exhaust path of a gas turbine engine comprising:

an optical viewing port ~~capable of being~~ mounted to the a gas turbine engine exhaust section to collect the radiant energy present in the exhaust path;

a sensor element comprising at least one spectrometer having a diffraction grating for refracting the radiant energy into different wavelengths and further having a detector array comprising a plurality of detectors, each detector that is sensitive to specific wavelengths of the refracted radiant energy produced from flame transmitted from said optical viewing port, wherein said sensor element emits an electrical signal when radiant energy is present; and,

~~an output means~~ a microprocessor, for receiving and interpreting the electrical signal in comparison to predefined parameters, connected to said sensor element and activated when flame has been detected in the exhaust path of the gas turbine causing the electrical signal, wherein the microprocessor produces an output relative to the electrical signal.

2. (Currently amended) The apparatus for detecting the presence of flame in the exhaust path of a gas turbine engine of claim 1 further comprising:

a fiber optic cable assembly mounted to receive the radiant energy from said the optical viewing port and to transmit the radiant energy to the sensor element[[;]]

~~an electro-optics module that restricts the spectral energy to wavelengths specific to the signatures of the flame source from a wavelength of 200 nm to 800 nm.~~

3. (Currently amended) The apparatus for detecting the presence of flame in the exhaust path of a gas turbine engine of claim 1 further comprising:

a computer to receive the microprocessor ~~said~~ output and make a determination of the state of the fuel nozzle clog.

4. (Original) The apparatus for detecting the presence of flame in the exhaust path of a gas turbine engine of claim 1 further comprising:

a storage device capable of saving said electrical signal from said sensor element for later analysis.

5. (Original) The apparatus for detecting the presence of flame in the exhaust path of a gas turbine engine of claim 1 further comprising:

a fiber optic cable assembly mounted to receive the radiant energy from said optical viewing port;

a collection optics to receive the radiant energy from said fiber optic cable and efficiently couple the radiant energy to said sensor element.

6. (Canceled)

7. (Currently amended) A method of determining the state of the fuel nozzle of a gas turbine comprising the steps of:

receiving radiant energy from the exhaust path of a gas turbine;

transferring the radiant energy to at least one sensor capable of detecting radiant energy; and,

determining an average of a baseline intensity of a normal background intensity of the radiant energy of a gas turbine known to be operating efficiently with clean fuel nozzles;

producing an electrical signal from the at least one sensor relative to the radiant energy;

comparing the electrical signal to the average of the baseline intensity;

indicating when radiant energy having an intensity greater than the baseline intensity within the range has been received from the exhaust path.

8. (Currently amended) The method of determining the state of the fuel nozzle of a gas turbine of claim 7, further comprising the step[[s]] of[:]] amplifying the radiant energy from the exhaust path of the gas turbine.

9. (Currently amended) The method of determining the state of the fuel nozzle of a gas turbine of claim 7, further comprising the step of filtering the radiant energy to a wavelength of about 200 to about 800 nm.

10. (Currently amended) A method of determining the state of the fuel nozzle of a gas turbine, comprising the steps of:

receiving radiant energy from the exhaust path of a gas turbine;

transferring the radiant energy to at least one sensor capable of detecting radiant energy produced from a flame ~~presence~~ present in the exhaust;

determining the average of the baseline intensity of the normal background intensity of the radiant energy of a gas turbine known to be operating efficiently with clean fuel nozzles;

producing a signal from the at least one of the sensors when the radiant energy in the 200 nm to 800 nm range has been received from the exhaust path;

comparing the output signal of the sensor to the average of the known baseline intensity; and

signaling the presence of flame when the signal produced has a relative intensity greater than that of the average baseline intensity.

11. (Currently amended) The method of determining the state of the fuel nozzle of a gas turbine of claim 10, further comprising the steps of: storing the baseline intensity

and signal produced from a sensor that indicated the presence of a flame in the exhaust.

12. (Currently amended) The method of determining the state of the fuel nozzle of a gas turbine of claim 10, further comprising the steps of:

measuring the duration of time that the relative intensity of the signal produced is greater than the baseline intensity; and

indicating to the operator of the gas turbine if the duration of time exceeds 30 ms.

13. (Currently amended) The method of determining the state of the fuel nozzle of a gas turbine of claim 10, further comprising the steps of:

measuring the intensity of the signal produced from the sensor; and

indicating to the operator of the gas turbine if the sensor output reaches a level greater than the average relative intensity of the baseline intensity by a predetermined amount based on the level of turbine activity.

14. (Currently amended) A method of detecting the presence of flame in the exhaust of a turbine engine, comprising the steps of:

gathering a light energy by the a view port attached to the exhaust plenum of a turbine engine;

transmitting said light energy by a fiber optic cable into a spectrometer through a fixed aperture;

striking light energy against a collimating mirror in the spectrometer;

directing said light energy from the collimating mirror at a diffraction grating;

refracting the light energy into wavelengths by a the grating;

directing the refracted light toward a focusing mirror;

reflecting the refracted ~~diffracted~~ light to strike onto a focusing mirror;

focusing the refracted light onto a detector array comprising a plurality of detectors;

concentrating the refracted light ~~in~~ in front of the detector array with a lens onto an individual detector ~~detectors~~;

responding to the an individual wavelength of light that strikes a detector element (pixel) with an electrical signal;

feeding said signals signal into a microprocessor;

interpreting a signal strength and information relative to the intensity of the individual wavelengths of light as received by said detector array, and ~~[[, ]]~~

providing information to an end user of the gas turbine.

15. (Currently amended) The method of claim 14, further comprising the step~~[[s]]~~ of~~[[:]~~ limiting the effects of second and third order wavelength harmonics using an order sorting filter.

16. (Currently amended) The method of claim 14, further comprising the step of determining the spectral nature of the flame condition being monitored.

17 –20. (Cancelled)

21. (Currently amended) The method of determining the presence of flame in the exhaust of a gas turbine, of claim 20 further comprising the steps of:

collecting spectral energy from the exhaust portion of a gas turbine;

transmitting said spectral energy to a sensor;

producing an electrical signal corresponding to the intensity and presence of a flame in the exhaust;

storing the electrical signal in a storage device;

providing a computer processor to evaluate the electrical signal; and

performing with the computer processor operations, further comprising the steps

of:

establishing a threshold level

$$T_i = \frac{1}{\alpha} \sum_{n=i+1}^{\alpha+i} \sqrt{X_n^2} + NT \Big|_{i=0}^{\infty}$$

wherein  $\alpha$  = running average interval,  $n$  = discrete sample

number,  $NT$  = noise threshold;

determining a sample intensity value

$$SI_i = \frac{1}{\alpha} \sum_{n=i+1}^{\alpha+i} \sqrt{X_n^2} \Big|_{i=0}^{\infty}$$

wherein  $\alpha$  = running average interval,  $n$  = discrete sample number;  
freezing the threshold level until the sample intensity value gets below the  
threshold level;

establishing an ending point of the flash interval

$$B = SI_i > T_i \Big|_{i=0}^{\infty};$$

establishing a total integrated intensity value

$$E = SI_i < T_{frozen} \Big|_{i=0}^{\infty};$$

establishing a total time captured for the flash interval

$$I = \sum_B^E SI_i - T_{frozen} \Big|_{i=0}^{\infty}$$

$$C = \sum_B^E i \Big|_{i=0}^{\infty}; \text{ and}$$

establishing a peak intensity value

$$P = SI_i \max \Big|_{i=0}^{\infty} \frac{1}{T_1}$$

wherein the results of operations  $T_1$ ,  $SI_1$ ,  $B$ ,  $E$ ,  $I$ ,  $C$  and  $P$  produced are  
stored in a memory device.



22. (Currently amended) The method of determining presence of flame in the exhaust of a gas turbine of claim 21, further comprising the steps of:

comparing the stored results of operations  $T_1$ ,  $SI_1$ , B, E, I, C and P; and  
determining that a condition requiring maintenance of the nozzles exists.

23. (Currently amended) The method of determining presence of flame in the exhaust of a gas turbine of claim 22, further comprising the step[[s]] of[[:]] indicating that a condition requiring maintenance of the turbine exists.